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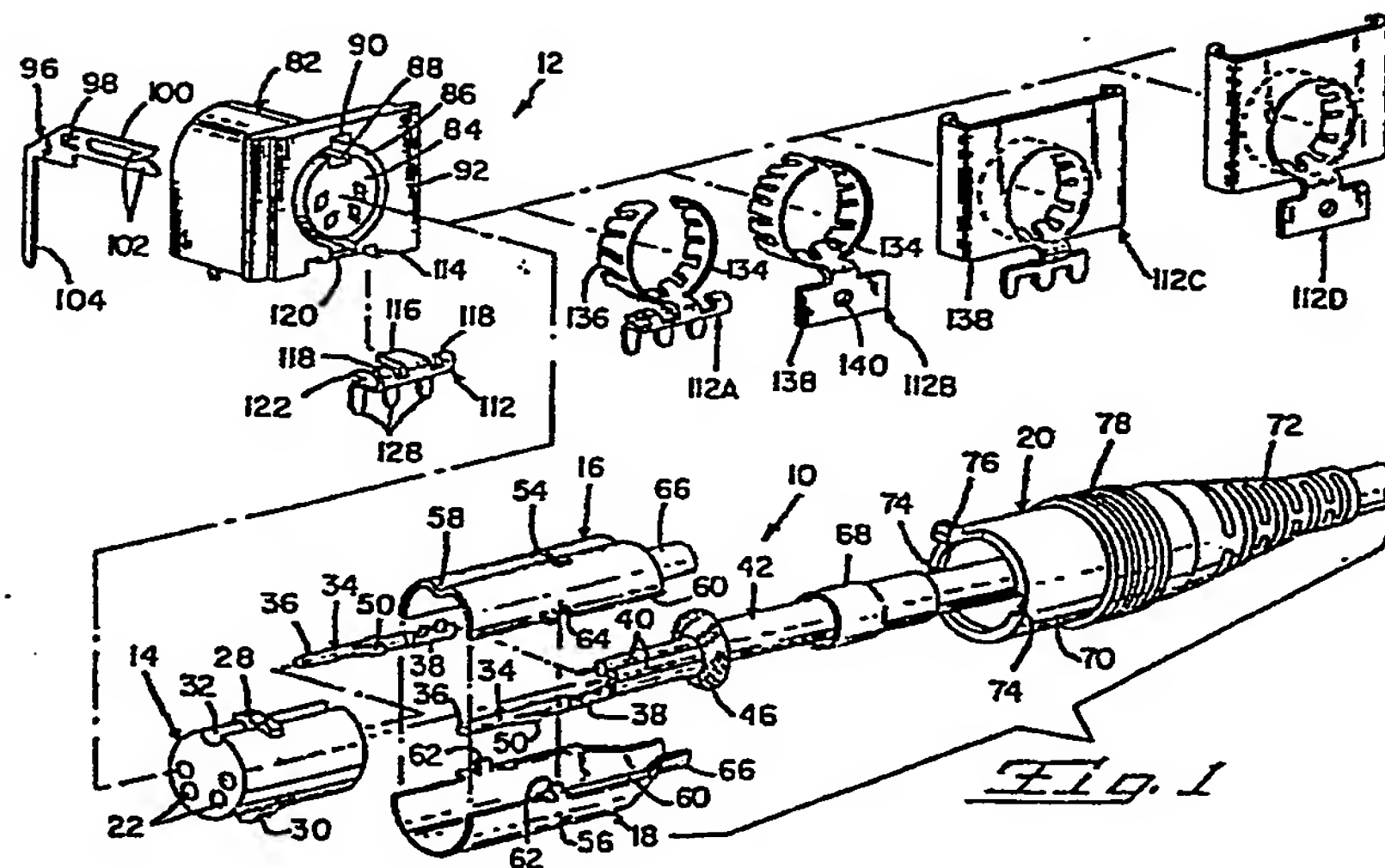
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(54) Electrical plug connector and receptacle therefor.

(57) An electrical connector of the plug type is shown in Figure 1 and comprises a dielectric housing member (14) having terminal passageways (22) therein in which electrical terminals (34) are latchably secured and have FORWARD contact sections (36), and also are electrically connected to a shielded cable (42). Metal clamshell members (16) and (18) are mounted on and surround housing member (14) extending forward to cover contact sections (36). A shield (46) of cable (42) surrounds a rear section of clamshell members (16) and (18) and is surrounded by a ferrule member (68) which is crimped to secure shield (46) to clamshell members (16) and (18) and to secure said clamshell members to housing (14), and is also crimped to insulating jacket (48) of cable (42). An insulating sleeve (20) is disposed around clamshell members (16) and (18) and cable (42). A receptacle (12) has a dielectric housing (82) with a section (84) containing terminals (98), a channel (86) around section (84) to receive a front section of clamshell members (16) and (18) of plug connector (10), and a ground terminal (112) secured by a spring contact (116) in a recess (114) extending into channel (86) and having ground contact means (128) exterior of housing means (82), terminals (98) to electrically receive contact sections (36) and having contact sections (104) extending outwardly from housing (82).

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ELECTRICAL PLUG CONNECTOR AND RECEPTACLE THEREFOR

This invention relates to electrical connectors and electrical plug connectors and receptacles therefor, for example of the DIN type.

Electrical connectors of the DIN type are known and they include  
5 a dielectric housing in which three to eight electrical terminals are molded. The terminals are soldered to electrical conductors of a shielded cable. Metal clamshell members are mounted onto the housing with one of the clamshell members having a U-shaped ferrule that is crimped onto the metal shield of the cable to terminate the shield and  
10 provide strain relief. An insulating strain relief member is disposed or molded onto the clamshell members and engages the cable adjacent the U-shaped ferrule thereby holding the clamshell members in position on the housing and providing a strain relief.

Soldering of conductors to terminals is time-consuming and cold  
15 solder connections can take place. The crimping of the U-shaped ferrule onto the metal shield does not result in a good termination or an effective strain relief. If the insulating strain relief member is pushed onto the clamshell members, this is not a desirable approach to holding the clamshell members in position. If the insulating strain  
20 relief member is molded onto the clamshell members, the open area of the back end of the clamshell members must be covered or viscous dielectric material positioned therein prior to molding to prevent material of the strain relief member from entering the soldered terminations which may break the terminations.

25 According to the present invention, an electrical connector of the plug type comprises a dielectric housing member in which electrical terminals are secured, contact sections of the electrical

5 terminals extend outwardly from a front surface of the dielectric housing member, and conductor-securing sections of the electrical terminals are to be connected to electrical conductors of a shielded cable. Metal clamshell members are mounted on the dielectric housing member forming an outer contact surrounding the dielectric housing member so that a front section covers the contact sections of the electrical terminals and a rear section is to be connected to a shield of the shielded cable. An insulating sleeve is disposed on the clamshell members and the cable. The conductor-securing sections are electrically connected to the electrical conductors and the electrical terminals are latchably secured in terminal passageways of the dielectric housing member, the rear section of the outer conductor has the shield positioned thereon so that a ferrule member can be crimped onto the rear section crimping the shield between the rear section and the ferrule member and, securing the clamshell members in position on the dielectric housing, the ferrule member is also to be crimped onto an insulating jacket of the cable.

10 According to another embodiment of the invention, a receptacle of the type for electrical connection with an outer contact and inner contacts of an electrical plug connector comprises a dielectric housing having a terminal-receiving section surrounded by a channel. The terminal-receiving section has passageways extending therethrough in which electrical terminals are latchably secured with contact sections of the electrical terminals positioned internally within the passageways for electrical connection with the matable contact sections of the plug connector. Other contact sections of the electrical terminals are positioned outwardly from the housing for electrical connection with conductive paths of a circuit board. A ground terminal is secured onto the housing and has a spring contact section disposed within the channel of the housing for electrical connection with the outer contact of the plug connector when the outer contact is positioned within the channel. A contact member of the ground terminal is to be electrically connected to a ground plane on the circuit board or to a metal chassis.

FIGURE 1 is an exploded and perspective view of the parts of the electrical plug connector and receptacle therefor.

FIGURE 2 is a perspective view of the assembled receptacle and plug connector but exploded from each other.

5 FIGURE 3 is a cross-sectional view of Figure 2.

FIGURE 4 is identical to Figure 3 but with the plug connector and receptacle in mated electrical engagement.

10 A plug connector 10 and receptacle 12 therefor is illustrated in the drawings and they are electrically matable with one another to interconnect a wide variety of electronic equipment, especially computer equipment. Plug connector 10 comprises a dielectric housing 14, clamshell members 16 and 18, and a cable guard member 20.

15 Dielectric housing 14 is molded from a suitable plastic material and has terminal-receiving passageways 22 extending therethrough and preferably varies in number from three to eight. As shown in Figures 3 and 4, each of terminal-receiving passageways 22 has a forward retention surface 24 and a rear stop surface 26. Projections 28, 30 extend outwardly from housing 14 and a U-shaped recess 32 extends along housing 14 on each side of projection 28 and passes  
20 therethrough.

Electrical terminals 34 are stamped and formed from a suitable metal in accordance with conventional stamping and forming operations and they include pin contact sections 36 and conductor-securing sections 38 which are crimped in accordance with conventional  
25 crimping practices onto the conductive cores of insulated electrical conductors 40 of a shielded electrical cable 42. As shown, cable 42 has insulated electrical conductors 40 positioned within an inner dielectric sheath 44 around which is disposed a braided metallic shield  
30 46 that is covered by an outer insulating jacket 48. Alternatively, shielded electrical cable 42 can be formed with electrical conductors twisted together and wrapped with a thin plastic film and the shield can be in the form of a thin metal foil wrapped around the plastic film encased electrical conductors with a stranded electrical wire extending  
35 along the cable within the wrapped metal foil. The cable can, of course, take other forms as desired.

After cable 42 has been stripped to expose the conductive cores of electrical conductors 40 and a suitable amount of shield 46, conductor-securing sections 38 of electrical terminals 34 are crimped onto the conductive cores of electrical conductors 40 whereafter terminated terminals 34 are latchably secured in terminal-receiving passageways 22 of housing 14 via spring lances 50 engaging forward retention surfaces 24 and stop sections 52 of conductor-securing sections 38 engaging rear stop surfaces 26 so that pin contact sections 36 extend outwardly from the forward surface of housing 14 as shown in Figures 3 and 4. In this way, electrical terminals 34 are latchably secured in passageways 22 for removal therefrom by depression of lances 50 to clear surfaces 24 if desired. Moreover, conductor-securing sections 38 of electrical terminals 34 are completely enclosed within housing 14.

Clamshell members 16 and 18, which are stamped and formed from suitable metal, are U-shaped and are now positioned on housing 14 with projections 28 and 30 extending through openings 54 and 56 in members 16 and 18 respectively while inwardly-directed arcuate projection 58 of clamshell member 16 is disposed in U-shaped recess 32 of housing 14. Members 16 and 18 have flanges 60 that engage each other and lugs 62 on member 18 are disposed in recesses 64 of flanges 60 on member 16 to position members 16 and 18 relative to one another prior to members 16 and 18 being secured together. Clamshell members 16 and 18 are necked down at their rear ends to smaller U-shaped sections 66 which form an annular member surrounding conductors 40 onto which braid 46 is positioned and ferrule member 68, which has been slidably positioned on cable 42, is moved onto the shield and controllably crimped onto the annular member and the outer jacket 48 to electrically connect shield 46 between ferrule member 68 and the annular member thereby forming an excellent mechanical and electrical connection as well as a strain relief for cable 42 in addition to securing clamshell members 16 and 18 onto housing 14 so that clamshell members 16 and 18 form an outer contact for the plug connector with a forward section surrounding contact sections 36 as shown in Figures 3 and 4.



Cable guard member 20 is molded from a suitable plastic material and includes a clamshell-engaging section 70 and a cable-engaging section 72. Cable-engaging section 72 comprises a plurality of concentrically molded and connected rings of external decreasing diameter towards the rear end which are dimensioned to closely receive cable 42 therethrough as shown in Figure 4. The rings serve to resiliently reinforce cable 42 from extreme lateral manipulation thereof. After clamshell members 16 and 18 have been secured in position on dielectric housing 14 via ferrule member 68, cable guard member 20 after having been positioned onto cable 42 is moved along cable 42 with clamshell-engaging section 70 being positioned onto clamshell members 16 and 18 as shown in Figures 2 through 4. Section 70 has diametrically opposed internal slots 74 into which flanges 60 of members 16 and 18 are disposed and they are wide enough to permit member 20 to rotate about 30° relative to clamshell members 16 and 18. A latching hook 76 extends outwardly from the front end of section 70 and a series of ribs 78 extend outwardly from the outer surface of section 70 adjacent section 72. As can be discerned, section 70 covers clamshell members 16 and 18 so that the forward end of section 70 is coincident with the forward surface of housing 14 as shown in Figures 3 and 4 and an opening 80 is located in section 70 to permit projection 30 of housing 14 to be disposed therein to maintain housing and cable guard member 20 in position on clamshell members 16 and 18.

Receptacle 12 comprises a dielectric housing 82 which is molded from a suitable dielectric material such as, for example, glass-filled nylon or the like, and it includes a terminal-receiving section 84 which is surrounded by a channel 86. A U-shaped recess 88 is located in terminal-receiving section 84 and is in communication with channel 86. An oppositely-disposed U-shaped recess 90 is located in hood section 92. Terminal-receiving passageways 94 extend through terminal-receiving section 84 in alignment with respective terminal-receiving passageways 22 in dielectric housing 14 of plug connector 10 and they include diametrically-opposed recesses in communication therewith as shown in Figures 1 and 2. Electrical

terminals 96 are disposed in terminal-receiving passageways 94 and are secured therein by lances 98 in engagement with stop surfaces (not shown) located within the passageways. Electrical terminals 98 have forked contact sections 100 which are located in the opposed  
5 recesses of the passageways and the free ends of contact sections 100 are provided with arcuate contact surfaces 102 on the inner surfaces thereof for wiping and spring electrical contact with pin contact sections 36 of electrical terminals 34 when the plug connector 10 is electrically mated with receptacle 12 as shown in Figure 4. Other  
10 contact sections 104 of electrical terminals 96 are disposed at right angles with respect to forked contact sections 100 and they extend through holes 106 in printed circuit board 108 for electrical connection with respective conductive paths 110 by solder connection therewith. Contact sections 104 can be in the form of action pins for  
15 electrical connection with plated through holes in the printed circuit board or the conductive paths.

Ground terminal 112 is positioned within a recess 114 in housing 82 with spring contact member 116 in the form of a cantilever beam extending into channel 86 while hook members 118 engage the top  
20 surface of support member 120 within recess 114 and legs 122 of ground terminal 112 are disposed in bottom recess 124 with lances 126 of legs 122 in engagement with the rear surface of support 120 through an opening in the bottom surface of the housing 82 in communication with channel 86, thereby latchably securing ground  
25 terminal 112 in position in housing 82 as shown in Figures 3 and 4. In this way, the front section of clamshell members 16 and 18 forming the outer contact of plug connector 10 is electrically connected with spring contact 116 of ground terminal 112 when this forward section is positioned in channel 86 as shown in Figure 4 with arcuate  
30 projection 58 being disposed in U-shaped recess 88 thereby polarizing plug connector 10 in receptacle 12. After plug connector 10 has been matably connected within receptacle 12 and illustrated in Figure 4, member 20 is rotated so that latching hook 76 is moved into engagement with the rear surface of hood section 92 through an  
35 opening 93 in the top of housing 82 in communication with recess 90



and channel 86, thereby latchably securing plug connector 10 in position in receptacle 12. Ground terminal 112 has other contact sections 128 which extend through holes 130 in printed circuit board 108 for electrical connection via soldering to ground plane 132.

5 Other embodiments of the ground terminal are illustrated in Figure 1 with ground terminal 112A being the same as ground terminal 112 with the exception that spring contact member 116 is replaced by an almost circular contact 134 having spring contacts 136 which is disposed in channel 86 for electrical engagement with the forward  
10 section of the outer conductor of plug connector 10. Ground terminal 112B has circular contact 134 but includes a planar contact 138 which is electrically connected to a metal chassis by screw through hole 140 to form the ground connection therewith. Ground terminal 112C is the same as ground terminal 112A except that the circular contact 134  
15 is formed from planar metal which is clinched onto hood section 92 and ground terminal 112D is a combination of ground terminal 112C and ground terminal 112B. Ground terminals 112A, 112B, 112C and 112D provide excellent connection as well as EMI protection.

As can be discerned, a plug connector has been described that  
20 is easy to assemble to securely maintain the clamshell members in engagement and to form an excellent electrical and mechanical connection between the conductors and shield of the cable and the contacts and outer contact of the connector. A receptacle for the plug connector has also been described that is easy to assemble and  
25 solder or connect to circuit paths and a ground plane of a circuit board as well as to provide excellent EMI protection for the connection between the plug connector and receptacle.

CLAIMS:

1. An electrical connector of the plug type comprises a dielectric housing member (14) in which electrical terminals (34) are secured, contact sections (36) of the electrical terminals (34) extend  
5 outwardly from a front surface of the housing member (14) and conductor-securing sections (38) of the electrical terminals (34) are to be connected to electrical conductors (40) of a shielded cable (42), metal clamshell members (16) and (18) are mounted on the housing member (14) forming an outer contact surrounding the housing  
10 member (14) and including a forward section covering the contact sections (36) of the electrical terminals (34) and a rear section for connection to a conductive shield (46) of the shielded cable, (42) an insulating sleeve (20) for disposition onto the clamshell members (16) and (18) and including a section (72) for engagement with the cable  
15 (42), characterized in that:

said housing member (14) has terminal-receiving passageways (22) which have stop surfaces (24) and (26) therein;

said conductor-securing sections (38) are crimpable onto  
20 conductive cores of insulated electrical conductors (40) of the shielded cable (42) and said electrical terminals (34) have latching members (50) and stop sections (52) for engagement with said stop surfaces (24) and (26) in said terminal-receiving passageways (22) to latchably secure said electrical terminals (34) in said  
terminal-receiving passageways (22);

25 said clamshell members (16) and (18) having U-shaped rear sections (66) which form an annular member onto which an end of a shield (46) of the shielded cable (42) is to be positioned, a ferrule member (68) is positionable onto said annular member over the shield (46) end and is crimpable thereon to electrically connect the shield  
30 (46) to said outer contact and to secure the clamshell members together.

2. A plug connector as set forth in claim 1, characterized in that said electrical terminals (34) are completely disposed in said terminal-receiving passageways (22) except for said contact sections  
35 (36).

3. A plug connector as set forth in claim 1, characterized in that said clamshell members (16) and (18) have flanges (60) along their edges in engagement with each other, lugs (62) of one of the clamshell members (18) disposed in recesses (64) in the other clamshell member (16) positioning said clamshell members (16) and (18) together.

4. A plug connector as set forth in claim 3, characterized in that said insulating sleeve (20) has internal slots (74) in which said flanges (60) are disposed, said slots (74) are substantially larger than said flanges (60) to permit said insulating sleeve (20) to rotate relative to said outer contact within the confines of said slots (74).

5. A plug connector as set forth in claim 4 wherein said section (72) of said insulating sleeve (20) in engagement with the cable (42) comprises a series of interconnected ring members of decreasing external diameter.

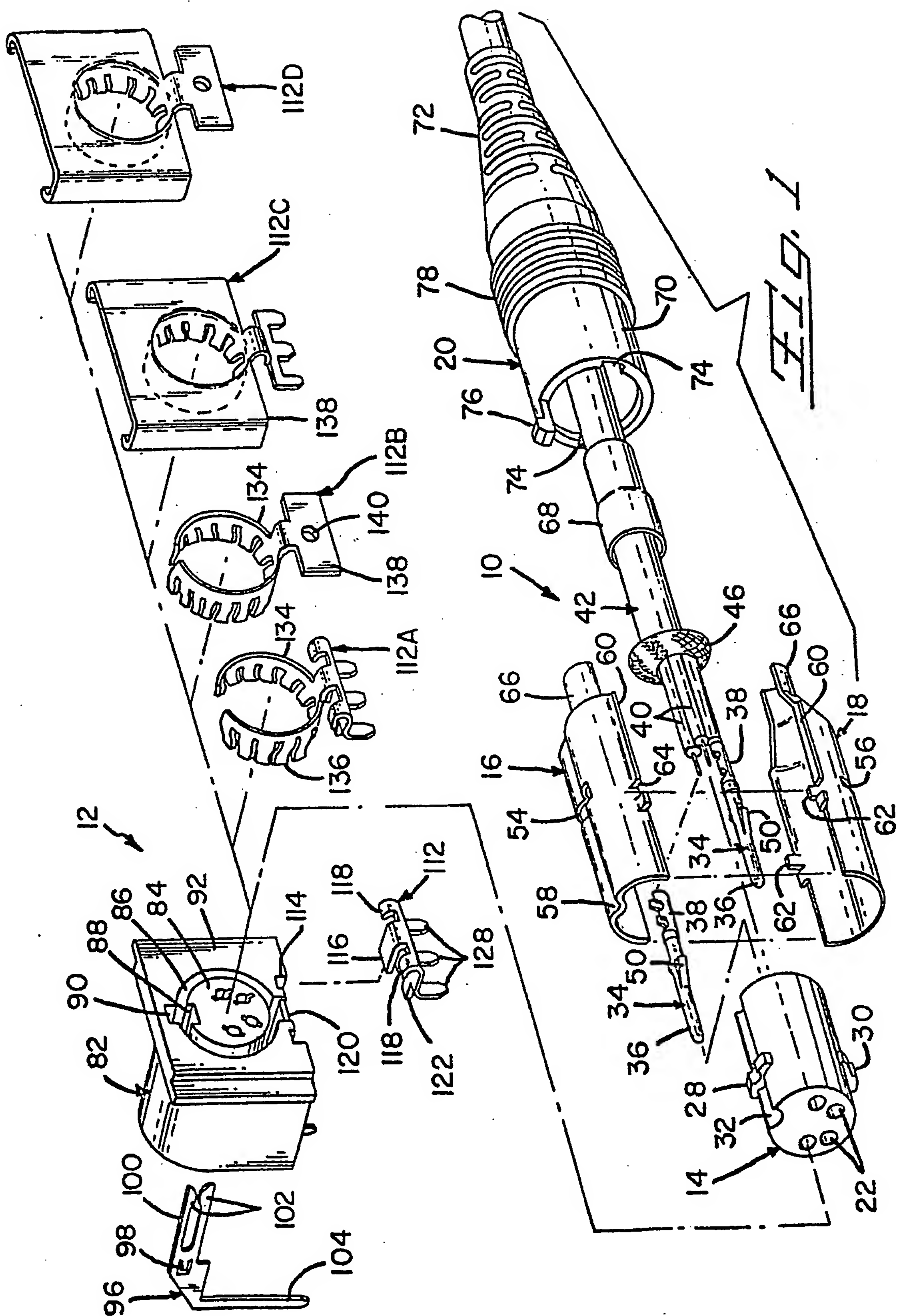
6. A plug connector as set forth in claim 1, characterized in that said housing member (14) has a U-shaped recess (32) in which an inwardly-directed arcuate projection (58) of one of the clamshell members (16) is disposed.

7. A receptacle (12) for electrical connection with an outer contact member and contact sections (36) of electrical terminals (34) of a plug connector (10), comprising: dielectric housing means (82) having a terminal-receiving section (84) in which terminal-receiving passageways (94) are located, said housing means having a channel (86) surrounding said terminal-receiving section (84); electrical terminal means (98) secured in said terminal-receiving passageways (94) and including contact section means (100) disposed within said terminal-receiving passageways (94) and other contact-section means (104) extending outwardly from said housing means (82); said housing means (82) having a recess (114) in communication with said channel (86); ground terminal means (112) having spring contact means

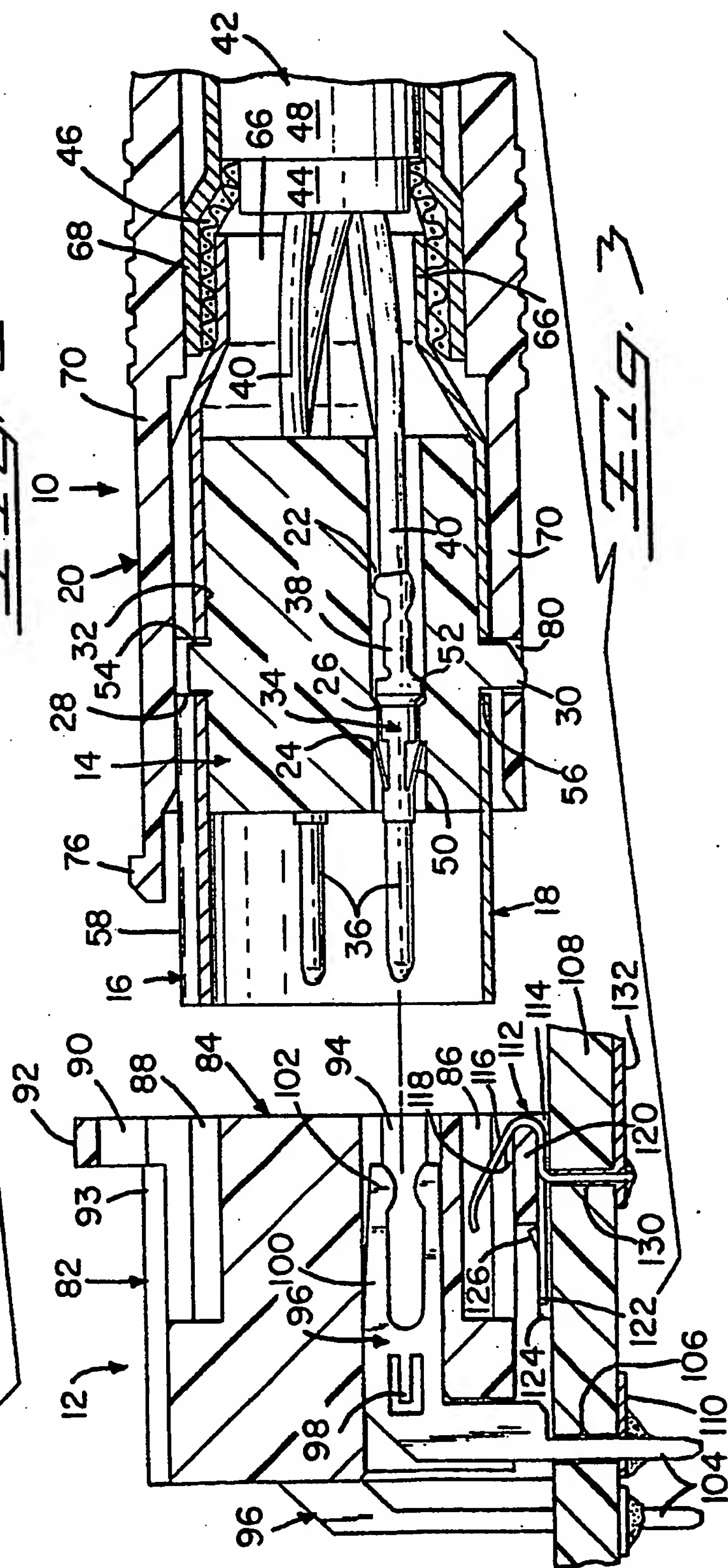
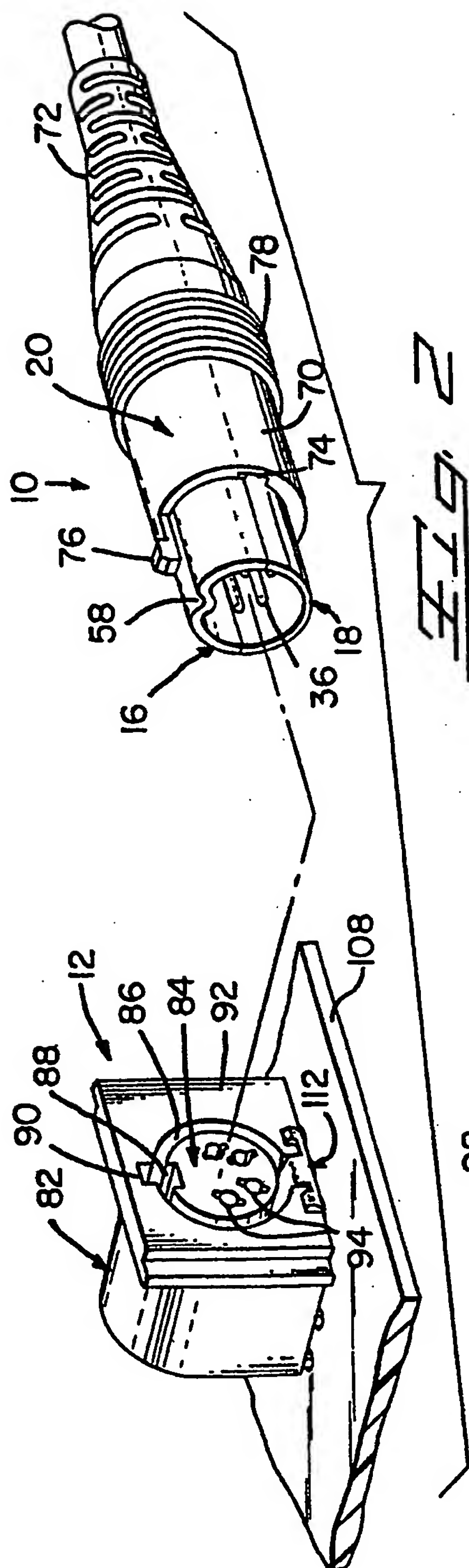
- 1 (116) disposed in said recess (114) and extending into  
said channel (86) for electrical contact with the outer  
contact member of the plug connector (10) when the  
outer contact member is inserted within said channel  
5 (86) and the contact sections (36) of electrical terminals  
(34) of the plug connector (10) are inserted into said  
terminal-receiving passageways (94) in electrical engage-  
ment with said contact section means (100), said ground  
terminal means (112) having ground contact means (128)  
10 or (138) positioned exteriorly of said housing means  
(82) for electrical connection with a ground member  
(132); and  
means provided by said ground terminal means (112) and  
said housing means (82) securing said ground terminal  
15 means (112) in said housing means (82).
8. A receptacle (12) as set forth in claim 7 wherein  
said terminal-receiving section (84) has a U-shaped  
recess (88) for engagement with an inwardly-directed  
arcuate projection (58) in the outer contact member  
20 of the plug connector (10).
9. A receptacle (12) as set forth in claim 7 wherein  
a front section of said housing means (82) has a hood  
section (92).
10. A receptacle (12) as set forth in claim 9 wherein  
25 said securing means comprises a support member (120)  
extending across said recess (114) and forms another  
recess in a bottom surface of said housing means (82),  
said ground terminal means (112) having hook members  
(118) engaging said support member (120) and legs (122)  
30 disposed in said other recess, lances (126) in said  
legs (122) engaging said support member (120).

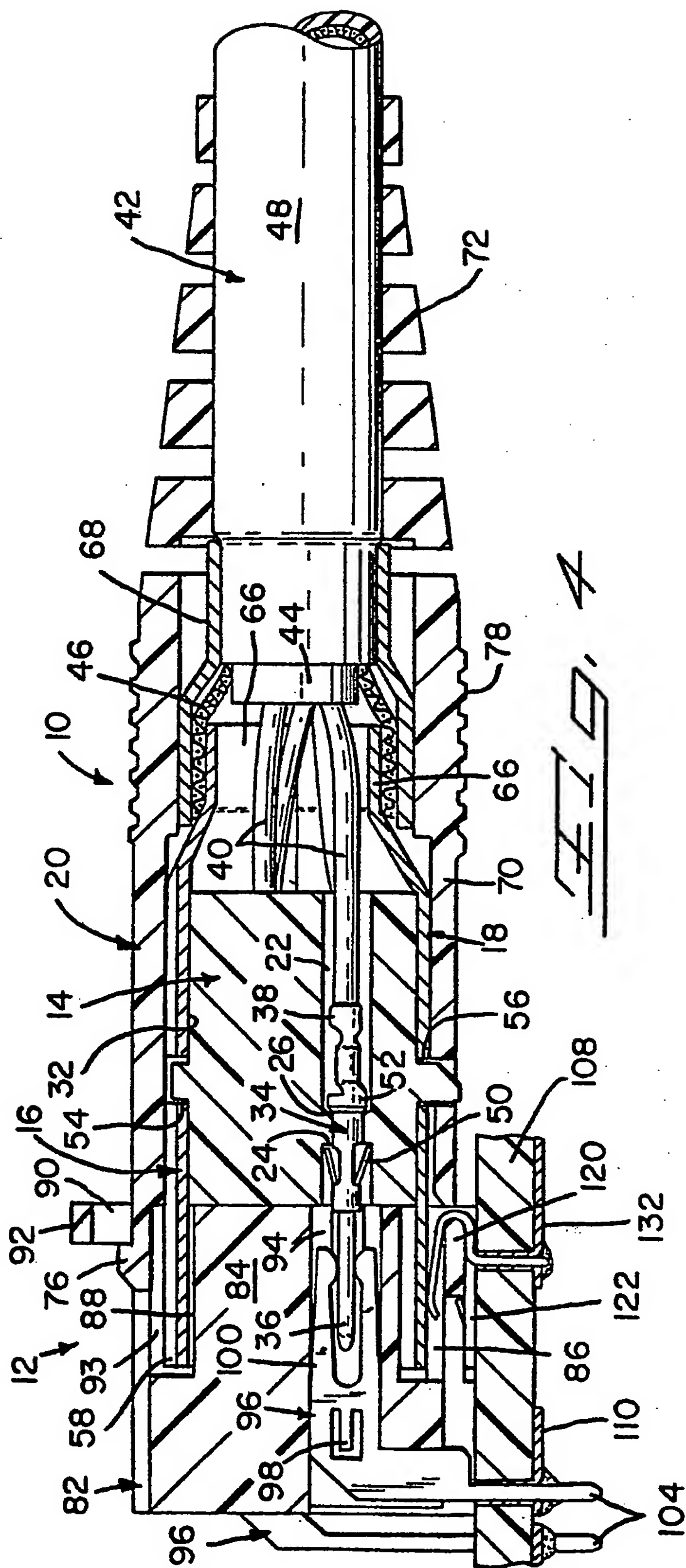
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- 1 11. A receptacle (12) as set forth in claim 10 wherein  
said spring contact means (116) is a cantilever beam.
12. A receptacle (12) as set forth in claim 10 wherein  
said spring contact means (116) is a near circular
- 5 member (134) having spring contact fingers (136).
13. A receptacle (12) as set forth in claim 10 wherein  
said spring contact means (116) is part of a planar  
member (138) secured to said hood section (92).











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# EUROPEAN SEARCH REPORT

0118168  
Application number

EP 84 30 0238

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 7)
Y	EP-A-0 040 941 (AMP) * Abstract; figures; page 4, lines 12-46 *	1	H 01 R 13/658
A		7, 11	
Y	US-A-4 310 213 (AMP) * Column 5, lines 16-59; figures 5-7 *	1	
A		2, 5, 6, 8	
A	US-A-3 986 765 (AMP) * Column 4, lines 47-64; figures *	1, 2, 4-6	
A	CH-A- 622 912 (AKICHIKA IIZUKA) * Figures *	1, 3	H 01 R
A	US-A-3 648 222 (BUNKER RAMO) * Figures *	12	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22-05-1984	Examiner RAMBOER P.
<b>CATEGORY OF CITED DOCUMENTS</b>			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

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